Engineering Design and Development (EDD)					
Course Description					
Engineering Design and Development (EDD) is the capstone course in the PLTW high school engineering program. It is an engineering research course in which students work in teams to design and develop an original solution to a valid open-ended technical problem by applying the engineering design process. The course applies and concurrently develops secondary level knowledge and skills in mathematics, science, and technology.					
Program of Study to which the course applies	**Course Code**				
STEM-	100163				
	Course Content	**Reference Standards**	**Crosswalk to Common Core Standards**	**Crosswalk to Nebraska Standards**	**Comments**
Standard 1: Introduction to Engineering Design and Development	Students will apply engineering design and process standards to begin investigating a problem.	PLTW-EDD			
Benchmark 1.1	Apply informed decision-making process in solving a problem.	PLTW-EDD	ELA.RST.11-12.3	LA.12.1.6.k LA.12.3.2 SC.12.1.3.a SC.12.1.3.b SC.12.1.3.c SC.12.1.3.d SC.12.1.3.e	Alignment presumes that students must comprehend oral or written instructions to complete the task (CC: ELA.RST.11-12.3; NE: LA.12.1.6.k, LA.12.3.2).

Performance Indicator 1.1.1	Identify the design process steps used in given scenarios and be able to list the steps.	PLTW-EDD			
Performance Indicator 1.1.2	Explain the process used to organize a research project.	PLTW-EDD			
Benchmark 1.2	Use technical and expository writing to communicate.	PLTW-EDD	WHST.11-12.2	LA.12.2.2	
Performance Indicator 1.2.1	Distinguish between when it is appropriate to use technical writing and expository writing styles.	PLTW-EDD			
Benchmark 1.3	Ensure the success of a project through effective project management.	PLTW-EDD			
Performance Indicator 1.3.1	Define and demonstrate time management skills as related to his or her project.	PLTW-EDD			

Benchmark 1.4	Understand elements of the design process most used by engineers including: defining a problem, brainstorming, researching, identifying requirements, exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype, testing, refining, making, and communicating	PLTW-EDD	ELA.WHST.11–12.4 ELA.WHST.11-12.7-9 ELA.SL.11-12.2 ELA.SL.11-12.5	LA.12.1.6.j LA.12.2.1.a LA.12.2.2.a LA.12.3.1.a LA.12.4.1.a-c SC.12.1.3.a SC.12.1.3.b SC.12.1.3.c SC.12.1.3.d SC.12.1.3.e	The depth of students' investigations, and thus the research standards that apply, will be determined by the nature of the task (CC: ELA.WHST.11-12.7–9; NE: LA.12.1.6.j, LA.12.4.1.a–c).
Performance Indicator 1.4.1	Identify the design process steps used in given scenarios and be able to list the steps.	PLTW-EDD			
Performance Indicator 1.4.2	Explain the process used to organize a research project.	PLTW-EDD			
Benchmark 1.5	Use an engineer's notebook to chronologically document all aspects of a design project.	PLTW-EDD	ELA.WHST.11-12.4 ELA.WHST.11-12.10	LA.12.2.2 SC.12.1.3.a SC.12.1.3.b SC.12.1.3.c SC.12.1.3.d SC.12.1.3.e	
Performance Indicator 1.5.1	Apply engineering notebook standards and protocols when documenting work.	PLTW-EDD			

Standard 2	Students will determine and describe the problem that will be solved.	PLTW-EDD			
Benchmark 2.1	Brainstorming is an effective technique used to generate problem statements to identified problems.	PLTW-EDD	ELA.SL.11–12.1	LA.12.3.3	
Performance Indicator 2.1.1	Brainstorm problem statements for unique innovations or inventions.	PLTW-EDD			
Benchmark 2.2	Writing a concise problem statement is the foundation in solving problems.	PLTW-EDD	ELA.WHST.11-12.4 ELA.WHST.11-12.7	LA.12.1.6.j LA.12.2.2	
Performance Indicator 2.2.1	Write concise problem statements using technical writing skills.	PLTW-EDD			
Benchmark 2.3	An accurately written problem statement aids in determining if the result of the engineering design and development process has solved the identified problem.	PLTW-EDD	ELA.WHST.11-12.4 ELA.WHST.11-12.7	LA.12.1.6.j LA.12.2.2 SC.12.1.3.e	
Performance Indicator 2.3.1	Write concise problem statements using technical writing skills.	PLTW-EDD			

Performance Indicator 2.3.2	Document research that justifies the problem statement for the engineering design and development project.	PLTW-EDD			
Standard 3	Students will verify and justify their rationale for a proposed engineering problem.	PLTW-EDD			
Benchmark 3.1	Generate an accurately written problem statement, which identifies a need and guides the design process that will be used in engineering design problems.	PLTW-EDD	ELA.WHST.11-12.4 ELA.WHST.11-12.7	LA.12.1.6.j LA.12.2.2 SC.12.1.3.e	
Performance Indicator 3.1.1	Write a problem statement as well as verify and justify the statement.	PLTW-EDD			
Performance Indicator 3.1.2	Document the project process in an engineering notebook.	PLTW-EDD			
Benchmark 3.2	Experts are professionals that guide the research needed for accurate justification and solutions to design problems.	PLTW-EDD			
Performance Indicator 3.2.1	Be able to speak to experts appropriately.	PLTW-EDD			

Performance Indicator 3.2.2	Ask valid questions that will be used to further the student's knowledge of the problem statement.	PLTW-EDD			
Performance Indicator 3.2.3	Use strong oral and written skills to communicate with experts.	PLTW-EDD			
Standard 4	Students will understand the research and development process.	PLTW-EDD			
Benchmark 4.1	Distinguish between R&D: research refers to the advancement of knowledge, and development refers to the application of knowledge	PLTW-EDD	ELA.RST.11-12.4	LA.12.1.5 SC.12.1.3.g	
Performance Indicator 4.1.1	Study cases (articles supplied by the teacher) regarding research and development and its impact on the invention and innovation of products, processes, or services	PLTW-EDD			
Benchmark 4.2	Understand market research aids business and industry in making better decisions about the development and marketing of new products	PLTW-EDD			

Performance Indicator 4.2.1	Study cases (articles supplied by the teacher) regarding research and development and its impact on the invention and innovation of products, processes, or services.	PLTW-EDD			
Performance Indicator 4.2.2	Create market research to investigate and determine the merit of their solution.	PLTW-EDD			
Performance Indicator 4.2.3	Self-assess their performance and research based on the goals for developing a solution to a problem.	PLTW-EDD			
Standard 5	Students will investigate current and past solutions to an engineering problem.	PLTW-EDD			
Benchmark 5.1	Understand a patent is a legally binding agreement between an inventor, owner, and the people of the United States that grants the exclusive right to produce and sell an invention or innovation for a certain length of time.	PLTW-EDD	ELA.RST.11-12.4	LA.12.1.5	
Performance Indicator 5.1.1	Research and identify patents related to their identified problem.	PLTW-EDD			
Performance Indicator 5.1.2	Create a matrix table to analyze the data found from the patent research.	PLTW-EDD			

Benchmark 5.2	Describe the series of steps that must be followed to secure a patent.	PLTW-EDD	ELA.WHST.11-12.2.b ELA.SL.11-12.4	LA.12.2.1.b LA.12.3.1.a	When students *describe* information or ideas, they communicate their knowledge through either speaking or writing. To demonstrate full knowledge on the topic, students' presentations must include all the main ideas and relevant details on the subject (CC: ELA.WHST.11-12.2.b, ELA.SL.11-12.4; NE: LA.12.2.1.b, LA.12.3.1.a).
Performance Indicator 5.2.1	Research how to obtain a patent.	PLTW-EDD			
Benchmark 5.3	Recognize research is used to investigate what solutions exist to a technical problem and if an innovation or new invention is warranted.	PLTW-EDD		SC.12.1.3.h	
Performance Indicator 5.3.1	Use a list of specifications and constraints identified in a decision matrix to develop a list of alternative solutions to the stated problem.	PLTW-EDD			
Performance Indicator 5.3.2	Conduct research to investigate and determine the merit of his or her alternative solution based on past solutions to the problem.	PLTW-EDD			
Performance Indicator 5.3.3	Explain the feasibility of his or her solution based on his or her research.	PLTW-EDD			

Performance Indicator 5.3.4	Develop research strategies for his or her solution, including the use of surveys, phone interviews, and personal contact with experts related to the field of his or her technical problem.	PLTW-EDD			
Performance Indicator 5.3.5	Create a matrix table to analyze the data found from the patent research.	PLTW-EDD			
Standard 6	Students will determine whether to invent or innovate as the process to provide a solution to a problem.	PLTW-EDD			
Benchmark 6.1	Describe various design solutions to technical problems such as an invention, something new, or they may be an innovation, a modification of an already existing solution.	PLTW-EDD	ELA.WHST.11-12.2.b ELA.SL.11-12.4	LA.12.2.1.b LA.12.3.1.a	When students *describe* information or ideas, they communicate their knowledge through either speaking or writing. To demonstrate full knowledge on the topic, students' presentations must include all the main ideas and relevant details on the subject (CC: ELA.WHST.11-12.2.b, ELA.SL.11-12.4; NE: LA.12.2.1.b, LA.12.3.1.a).
Performance Indicator 6.1.1	Conduct research to identify the difference between innovation and invention.	PLTW-EDD			
Benchmark 6.2	Recognize inventions and innovations are the results of specific, goal-directed research.	PLTW-EDD		SC.12.1.3.h	

Performance Indicator 6.2.1	Conduct research to identify the difference between innovation and invention.	PLTW-EDD			
Benchmark 6.3	Understand creative thinking and economic and cultural influences shape the development of solutions to technical problems.	PLTW-EDD		SC.12.1.3.h	
Performance Indicator 6.3.1	Write a fictional scenario for an innovation of interest.	PLTW-EDD			
Performance Indicator 6.3.2	Sketch one invention and one innovation related to the technical problem.	PLTW-EDD			
Benchmark 6.4	Utilize assessment techniques, such as trend analysis, to provide information to determine if a solution should be pursued to design and development.	PLTW-EDD		SC.12.1.1.g	
Performance Indicator 6.4.1	Discuss the pros and cons of a decision matrix.	PLTW-EDD			
Performance Indicator 6.4.2	Conduct research and perform a trend analysis on a technical problem.	PLTW-EDD			
Standard 7	Students will document the design solution for the product.	PLTW-EDD			

Benchmark 7.1	Understand specifications for a design solution enhance creativity by identifying the criteria and constraints of the design process.	PLTW-EDD		SC.12.1.3.a	
Performance Indicator 7.1.1	Create a description of the product specifications for the design solution.	PLTW-EDD			
Benchmark 7.2	Use a decision matrix to evaluate the preliminary design solution by implementing multiple parameters.	PLTW-EDD	ELA.RST.11-12.3	LA.12.1.6.k LA.12.3.2 SC.12.1.3.b	Alignment presumes that students must comprehend oral or written instructions to complete the task (CC: ELA.RST.11-12.3; NE: LA.12.1.6.k, LA.12.3.2).
Performance Indicator 7.2.1	Objectively evaluate proposed design solutions using specific criteria.	PLTW-EDD			
Performance Indicator 7.2.2	Select the best design solution option using a decision matrix.	PLTW-EDD			
Benchmark 7.3	Use optimization to improve the final design solution by justifying the specifications applied.	PLTW-EDD		SC.12.1.3.e	
Performance Indicator 7.3.1	Objectively evaluate proposed design solutions using specific criteria.	PLTW-EDD			
Performance Indicator 7.3.2	Select the best design solution option using a decision matrix.	PLTW-EDD			
Performance Indicator 7.3.3	Graphically represent the results of the design solution evaluation.	PLTW-EDD			

Standard 8	Students will use symbols and drawings to communicate and evalute the design solution for the problem	PLTW-EDD			
Benchmark 8.1	Use of symbols and drawings to promote clear communication of a design solution.	PLTW-EDD	ELA.WHST.11-12.6 ELA.SL.11-12.5 MTH.G.MG.3	LA.12.2.1.f LA.12.3.1.c MA.12.2.4.a SC.12.1.3.e	
Performance Indicator 8.1.1	Sketch all parts of their design solution including an isometric view of the assembled product.	PLTW-EDD			
Performance Indicator 8.1.2	Create a set of working drawings for their design solution.	PLTW-EDD			
Performance Indicator 8.1.3	Refine their design solution, if necessary, based upon expert feedback.	PLTW-EDD			
Benchmark 8.2	Utilize drawings and sketches to organize, record, and communicate ideas to experts.	PLTW-EDD	ELA.WHST.11-12.6 ELA.SL.11-12.5 MTH.G.MG.3	LA.12.2.1.f LA.12.3.1.c MA.12.2.4.a	
Performance Indicator 8.2.1	Sketch all parts of their design solution including an isometric view of the assembled product.	PLTW-EDD			

Performance Indicator 8.2.2	Create a set of working drawings for their design solution.	PLTW-EDD			
Performance Indicator 8.2.3	Refine their design solution, if necessary, based upon expert feedback.	PLTW-EDD			
Benchmark 8.3	Use working drawings to show all the information needed to make a single part, subassembly, or a complete design solution.	PLTW-EDD	ELA.WHST.11-12.6 ELA.SL.11-12.5 MTH.G.MG.3	LA.12.2.1.f LA.12.3.1.c MA.12.2.4.a SC.12.1.3.e	
Performance Indicator 8.3.1	Refine their design solution, if necessary, based upon expert feedback.	PLTW-EDD			
Performance Indicator 8.3.2	Document the project's progress in their engineering notebooks.	PLTW-EDD			
Benchmark 8.4	Evaluate design solutions through technical drawings for any necessary refinements.	PLTW-EDD	ELA.RST.11-12.7	LA.12.1.6.f SC.12.1.3.d	
Performance Indicator 8.4.1	Refine their design solution, if necessary, based upon expert feedback.	PLTW-EDD			
Performance Indicator 8.4.2	Document the project's progress in their engineering notebooks.	PLTW-EDD			

Standard 9	Students will build a prototype of the device.	PLTW-EDD			
Benchmark 9.1	Apply tool machine safety to prevent accidents during the construction of the prototype	PLTW-EDD	ELA.RST.11-12.3	LA.12.1.6.k LA.12.3.2	Alignment presumes that students must comprehend oral or written instructions to complete the task (CC: ELA.RST.11-12.3; NE: LA.12.1.6.k, LA.12.3.2).
Performance Indicator 9.1.1	Identify safe practices for the use of tools and equipment.	PLTW-EDD			
Performance Indicator 9.1.2	Create a detailed set of instructions for producing a testable prototype based on the information gained through their research	PLTW-EDD			
Benchmark 9.2	Write step-by-step instructions for the prototype assembly to guide the fabrication of the design solution	PLTW-EDD	ELA.WHST.11-12.2 ELA.WHST.11-12.4	LA.12.2.2	
Performance Indicator 9.2.1	Identify safe practices for the use of tools and equipment.	PLTW-EDD			
Performance Indicator 9.2.2	Create a detailed set of instructions for producing a testable prototype based on the information gained through their research	PLTW-EDD			

Benchmark 9.3	Understand how availability of materials and equipment is determined by using a materials and cost analysis during the prototyping phase of a project.	PLTW-EDD		MA.12.1.3.d	
Performance Indicator 9.3.1	Identify methods and sources for obtaining materials and supplies.	PLTW-EDD			
Performance Indicator 9.3.2	Compile a materials list that includes vendors and cost for all necessary materials and equipment to build their prototype.	PLTW-EDD			
Benchmark 9.4	Recognize prototyping provides the engineer with a scaled working model of the design solution.	PLTW-EDD			
Performance Indicator 9.4.1	Identify safe practices for the use of tools and equipment.	PLTW-EDD			
Performance Indicator 9.4.2	Build a working prototype that can be tested.	PLTW-EDD			
Standard 10	Students will develop a testing method for their engineering problem.	PLTW-EDD			
Benchmark 10.1	Determine specific criteria for success or failure of a test before testing commences.	PLTW-EDD			

Performance Indicator 10.1.1	Select and describe a valid testing method that will be used to accurately evaluate their design solution's ability to solve their problem.	PLTW-EDD			
Performance Indicator 10.1.2	Devise a list of testing criteria that will be used to evaluate the success or failure of their prototype testing.	PLTW-EDD			
Benchmark 10.2	Describe prototype testing as a controlled procedure that is used to evaluate a specific aspect of a design solution.	PLTW-EDD	ELA.WHST.11-12.2.b ELA.SL.11-12.4	LA.12.2.1.b LA.12.3.1.a	When students *describe* information or ideas, they communicate their knowledge through either speaking or writing. To demonstrate full knowledge on the topic, students' presentations must include all the main ideas and relevant details on the subject (CC: ELA.WHST.11-12.2.b, ELA.SL.11-12.4; NE: LA.12.2.1.b, LA.12.3.1.a).
Performance Indicator 10.2.1	Prepare a description of the testing method that will be used to validate the designed solution.	PLTW-EDD			
Performance Indicator 10.2.2	Document their project's progress in their engineer's notebook.	PLTW-EDD			
Benchmark 10.3	Understand the results of prototype testing are used to refine the design and to improve the design solution.	PLTW-EDD		SC.12.1.3.d	

Performance Indicator 10.3.1	Identify, define, and implement needed modifications to their testing method based on expert feedback and their ongoing research.	PLTW-EDD			
Performance Indicator 10.3.2	Create a valid justification for the selected testing method.	PLTW-EDD			
Performance Indicator 10.3.3	Document their project's progress in their engineer's notebook.	PLTW-EDD			
Standard 11	Students will test a designed solution to their engineering problem.	PLTW-EDD			
Benchmark 11.1	Write a detailed description of the testing procedure to ensure the testing of the design solution is valid.	PLTW-EDD	ELA.WHST.11-12.2 ELA.WHST.11-12.4	LA.12.2.2 SC.12.1.3.e	
Performance Indicator 11.1.1	Create a detailed set of instructions for testing the prototype that will be valid, repeatable, and reliable.	PLTW-EDD			
Benchmark 11.2	Evaluate the test results allows engineers to determine if the test is accurate and repeatable.	PLTW-EDD	ELA.RST.11-12.7	LA.12.1.f MA.12.4.2.a SC.12.1.3.d	
Performance Indicator 11.2.1	Apply the appropriate statistical analysis tools to the test results to ensure validity.	PLTW-EDD			

Performance Indicator 11.2.2	Identify, define, and implement necessary modifications to their design based upon their test results.	PLTW-EDD			
Performance Indicator 11.2.3	Identify how their solution has removed obsolescence of the original product, if appropriate.	PLTW-EDD			
Performance Indicator 11.2.4	Evaluate and explain the effectiveness of their design at solving the problem they have defined.	PLTW-EDD			
Performance Indicator 11.2.5	Document the test results and project progress in their engineering notebooks.	PLTW-EDD			
Standard 12	Students will document the design process and project through written and multimedia forms.	PLTW-EDD			
Benchmark 12.1	Utilize presentation software to provide visual aids and project information in a professional manner.	PLTW-EDD	ELA.SL.11-12.5	LA.12.3.1.c	
Performance Indicator 12.1.1	Gather data and information compiled throughout the project and create a technical research paper, PowerPoint, and three panel display of their design solution.	PLTW-EDD			

Benchmark 12.2	Write a technical report to provide thorough communication of all aspects of a design solution.	PLTW-EDD	ELA.WHST.11-12.2	LA.12.2.2 SC.12.1.3.e	
Performance Indicator 12.2.1	Choose one of the formats used to depict the design solution, such as technical reseach paper, PowerPoint, three panel display, or website, if created, for the presentation of the solution to their chosen problem.	PLTW-EDD			
Benchmark 12.3	Explore the various media formats available to select, and then, effectively communicate the design solution process to a target audience.	PLTW-EDD	ELA.WHST.11-12.6 ELA.SL.11-12.5	LA.12.2.1.f LA.12.3.1.c	
Performance Indicator 12.3.1	Create a website, if they choose, in order to depict all aspects of their design solution.	PLTW-EDD			
Standard 13	Students will formally present their design solution to peers and other stakeholders.	PLTW-EDD			

Benchmark 13.1	Communicate their design solutions through the utilization of effective public speaking skills and visual presentation technology.	PLTW-EDD	ELA.SL.11–12.4-6	LA.12.3.1 SC.12.1.3.e	
Performance Indicator 13.1.1	Identify appropriate techniques for delivering formal presentations.	PLTW-EDD			
Performance Indicator 13.1.2	Orally present an effective technical presentation on the chosen design solution.	PLTW-EDD			
Benchmark 13.2	Understand resumes are used by engineers to promote their knowledge and skills when searching for employment.	PLTW-EDD	ELA.RST.11-12.5	LA.12.1.6.k	
Performance Indicator 13.2.1	Write a resume to prepare for an interview in college or the workforce.	PLTW-EDD			
Performance Indicator 13.2.2	Update their portfolio with accompanying resume as professional documentation of their knowledge and skills and work completed in this course.	PLTW-EDD			